Wastewater Treatment Division

Appendix D:
IT Architecture

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Westin Engineering, Inc. Project 6251

Figures

1. ROLE OF IT ARCHITECTURE

1.1. Introduction

The results of the Computer Systems Planning Study are documented in this Computer Systems Master Plan, which consists of:

- Executive Summary
- Master Plan
- Appendix A – Cost Saving Benefits
- Appendix B – IT Staffing
- Appendix C – IT Standards
- ***Appendix D – IT Architecture***
- Appendix E – Existing Condition Assessment
- Appendix F – Projects and Subprojects

This is Appendix D – IT Architecture. The purpose of this appendix is to provide a conceptual definition of the IT Architecture. This conceptual definition needs to be read and utilized by WTD staff who are assigned to manage or direct IT projects within the Wastewater Program to ensure that individual project will result in the building of the recommended IT Architecture. Once the Program – as defined in the Master Plan – is initiated, a Program Manager will need to be assigned. The Program Manager should obtain the services of an IT Architect or a consultant to help the Division in the QA/QC process to ensure that projects are consistent with the IT Architecture. The QA/QC process will also be used to make periodic improvements or adjustments to the IT Architecture every 3-4 years to keep current with the latest technology trends.

The implementation of the recommended IT Architecture will provide the Division with a better return on its investment in computers and computing systems. The recommended IT Architecture will help the Division save time and money by making staff more productive and making the computing environment easier to maintain. The IT Architecture will allow the Division to achieve the goal of providing fast, easy reliable access to accurate, relevant job specific data.

The goal of the Master Plan is to create an integrated system as conceptually illustrated below.

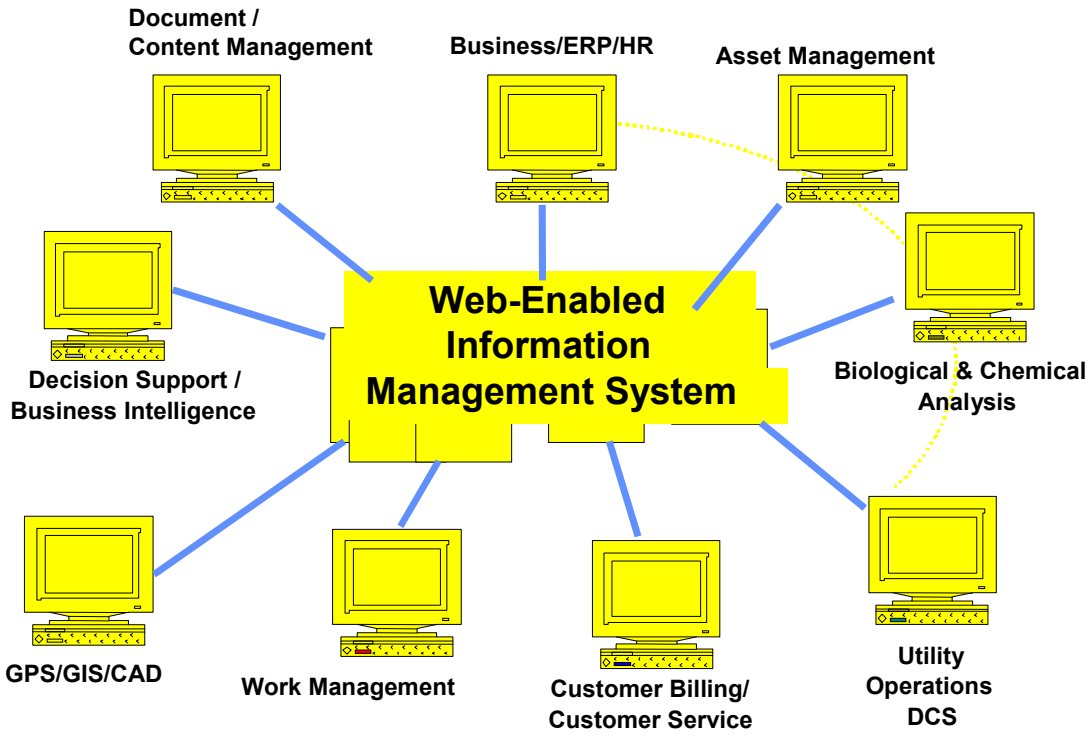

Figure D-1: Integrated System

1.1. Realization of a Integrated System

The WTD IT Architecture is the technical realization of WTD's vision of wide-scale data sharing. This IT Architecture will help the Division reach established productivity goals and objectives.

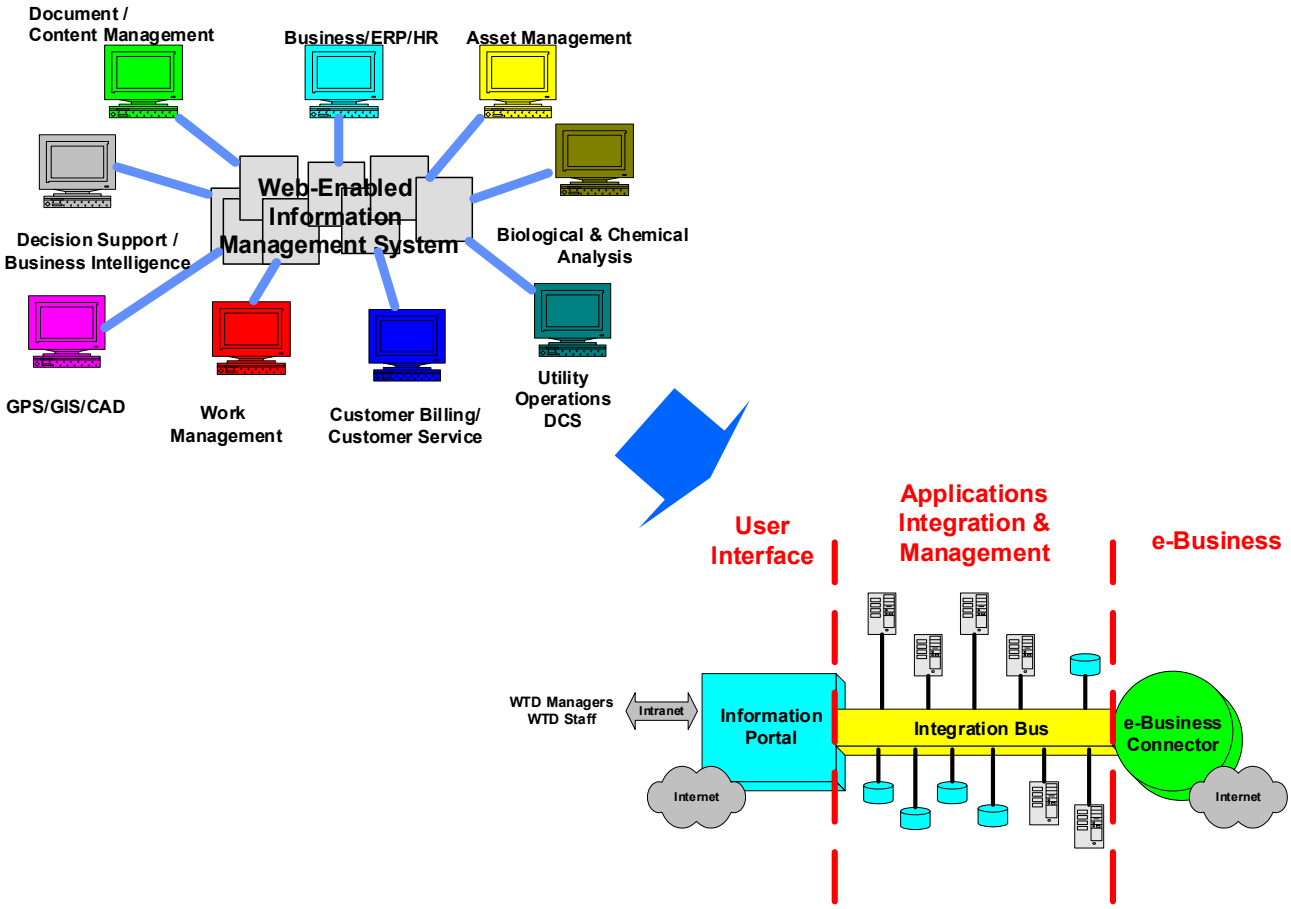

Figure D-2: WTD Vision

There are three major aspects of the IT Architecture:

1) User Access – provided by a web-based **Information Portal**, enabling access to a variety of databases and applications for Division managers and staff

2) Data and Workflow Integration – provided by an **Integration Bus**, which links together the various databases and applications in the Division

3) Connection to Other Governmental Agencies and the Public – provided by an **e-Business Connector**, which links Division managers and staff to customers, suppliers, and external agencies either directly or via Internet-based B2B (Business-to-Business) exchanges.

1.2. Overview of IT Architecture

The WTD IT Architecture is the technical realization of Division's goal to provide fast, easy and reliable access to accurate relevant job specific data. This IT Architecture is being implemented by the Division in order to achieve productivity goals and objectives. The IT Architecture will allow Division managers and staff to readily access databases and applications, such as those for Maintenance Management and Project Management. The IT Architecture provides access to all information sources and eliminates confusion associated with trying to figure out where specific information is located and how to get it.

End-users experience little or no learning curve in using an Information Portal because the interface is familiar, similar to common portals such as those utilized by Yahoo!, AltaVista, and other internet web browsers. End-users benefit from having one personalized portal from which they can access all their chosen content. And they aren't hindered by having to filter out irrelevant information; their personalized view of Division data can be set up to support their specific role(s) in the Division. All organizational units and functions within the Division can benefit because their information is unlocked from many different applications and delivered selectively and in a timely manner to people that need the information. The effect is a streamlined workflow process, increased efficiency and improved responsiveness.

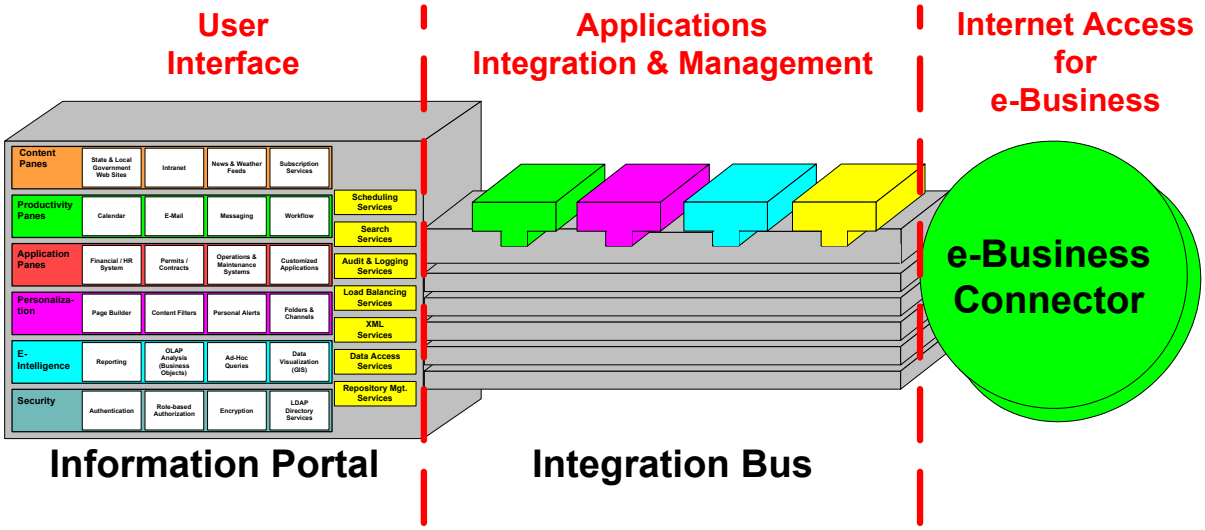

Figure D-3: IT Architecture

The IT Architecture promotes information sharing through a publish-subscribe paradigm. As certified data is ready to be shared, it can be readily published to the end-users of that data. Information users can configure their own personalized portal to subscribe to the data that they want to see. No longer is time wasted in trying to determine who needs data or in trying to find data.

A slightly more detailed rendering of the IT Architecture is shown below. As illustrated below, applications "snap" into the Integration Bus, which then "pipes" information into the Information
Portal.
The Information Portal becomes the single access point for users, meeting all of their information access needs with a simple to learn and user interface. This dramatically reduces the time it takes to train users to use computer tools used to access data, reduces the time it takes to publish data and the time it takes to subscribe or access data. All of this culminates in significant cost savings and productivity improvements for the Division.

1.3. The Integration Bus Functions

Figure D-1: Integration Bus, illustrates:

1) How applications and databases are added or "snapped" into the Integration Bus;
2) The variety of applications that can be added to the Integration Bus; and
3) The technical layers that are used to build the Integration Bus

These three elements will allow staff to manage the growth of the Integration Bus to meet the specific data needs of the Division. Staff can determine the level of integration required to meet the data needs of the Division and develop a migration plan to achieve it. The level of flexibility provided by the Integration Bus is a significant improvement over existing conditions and will allow the Division to better manage and integrate computer assets. The Integration Bus will allow staff to implement a migration plan that will provide staff with fast, easy and reliable access to relevant job specific data.

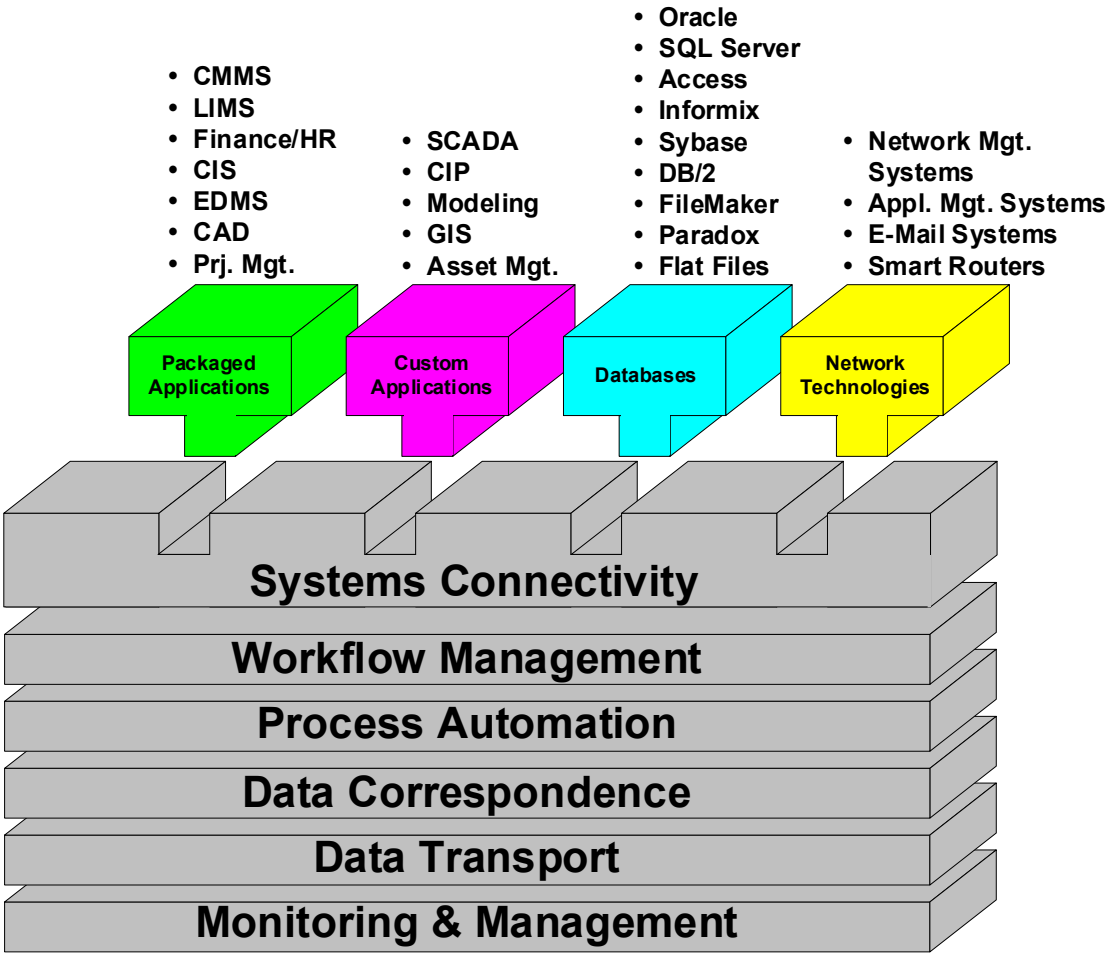

Figure D-4: Integration Bus

The following is a brief description of the various layers of the Integration Bus, how the Integration Bus works and how applications and databases are connected and integrated:

Systems Connectivity
Applications are connected to the Integration Bus through specialized adapters. These adapters are designed to link databases to off-the-shelf applications, custom-built applications and various networking technologies.

Workflow Management
This technical component automates manual processes. Places where the Division is using paper-based, manual processes can be automated with this technical component. It dramatically reduces paper and the need for human intervention to move that paper to along in a chain of work. This technical component streamlines workflow processes and improves productivity.

Process Automation
This technical component performs the actual work of automating the exchange of data between applications. A typical example is where data entered into one application is also needed by another application. Instead of having to re-type that data into the other application, it can be automatically routed to that other application. This reduces data redundancy, increases data accuracy and improves productivity.

Data Correspondence
This technical component allows for data exchange between applications that have different data structures. It is analogous to being able to automatically translate English to French.

Data Transport
This technical component of the Integration Bus enables data to be exchanged between applications regardless of format. It is analogous to being able to automatically reformat Morse Code into written English.

Monitoring and Management
This is a system control component that monitors the status and efficiency of the applications connected to the Integration Bus. From a control station monitor, a network manager can view all databases and applications to see how well they are performing and monitor potential or actual performance problems. For instance, it monitors the number of users attempting to access an application and how fast the application is responding to requests for information.

1.4. The Information Portal Functions

The Information Portal provides access to all forms of information: databases, spreadsheets, reports, drawings, specifications and maps. It also provides access to applications. This allows users to focus on their work, on making decisions and taking action on those decisions, rather than on trying to find and access information. The diagram below illustrates how the end users can access and compile information from different sources to make a decision required to complete assignments.

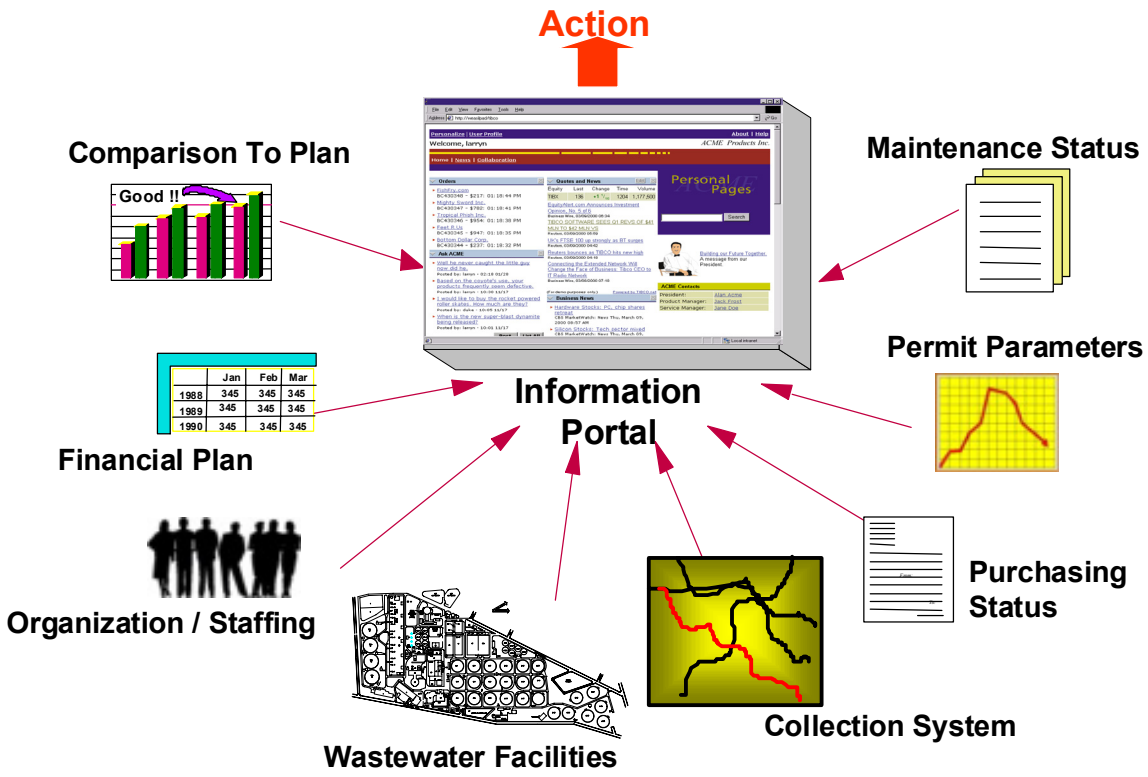

Figure D-5: Access to Different Data Sources

The Information Portal consists of a number of highly useful functions that will provide staff with fast, easy and reliable access to relevant job specific data. These functions are provided through the individual "window panes" that are used to build the Information Portal. An example of an Information Portal is illustrated below and is intended to show how the panes are used to construct the Information Portal. The end-user simply clicks on a pane to access information that is linked to that particular pane.

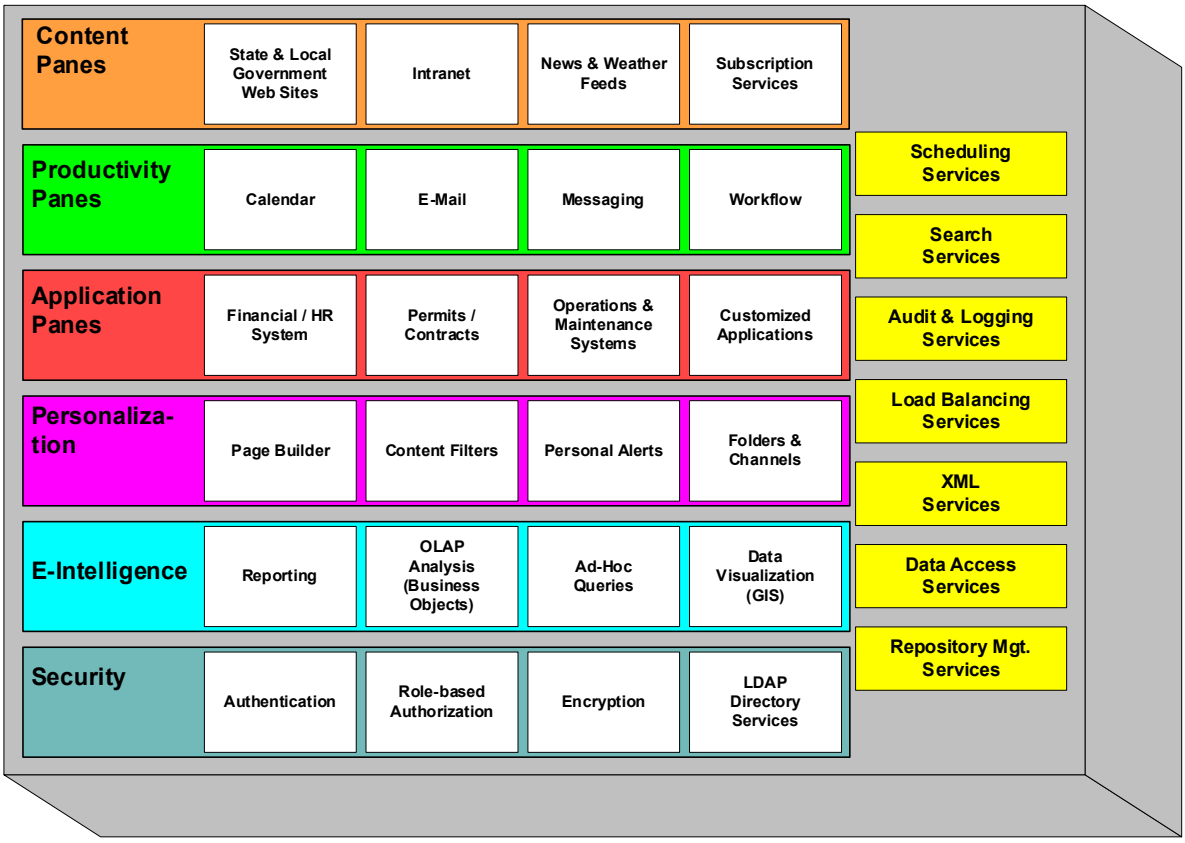

Figure D-6: Information Portal

Some of the unique capabilities of the Information Portal include:

Content Panes

The Information Portal can have a number of panes on the user screen. Some of those panes can be for receiving content (that is, data formatted in the way the user needs to view it) from any number of sources, including:

- State & Local Government Web Sites – Report updates or data that a user regularly wants to receive from another agency's web site can be automatically fed into a Content Pane on the user's screen. When the user logs in and brings up his/her personalized portal, this Content Pane (and the updated information from another agency's web site) is automatically there for viewing.
- Intranet – Any certified data that is published within the Division can be subscribed to. That is, when the user logs in, the user can view any number of automated data feeds. The user simply selects those data feeds that he/she wants to receive from a list of certified data.
- News & Weather Feeds – Any information published anywhere on the Internet can be automatically (and securely) delivered for viewing. Pertinent information might include a Content Pane that has the local weather radar feed, enabling the user to continuously monitor the weather as he/she continues to work on other things on their computer desktop.
- Subscription Services – There are a wide variety of subscription services on the Internet. For a fee, a user can receive regular updates or reports from a selected subscription service.

Productivity Panes
These panes are linked to what is commonly referred to as desktop productivity software, such as calendar, email, instant messaging, and workflow automation. The recommended migration path is to first integrate existing desktop productivity software – such as Microsoft Outlook – into the Information Portal. Later, as the Integration Bus is implemented and workflow becomes automated, the Division can provide staff with even more powerful productivity tools.

Application Panes
As applications are linked to the Information Portal, users can nominate to receive either automated content feeds to a Content Pane or to view and work with the application itself. Application Panes bring the power of the Information Portal by enabling users to view and work with applications and application functions directly. Of course, the ability of users to initiate transactions using an application would require prior authorization. However, assuming a user has been granted such privilege, he/she would be able to navigate to and within the application with just a few clicks. The Information Portal greatly simplifies the accessibility and use of applications, reducing IT administrative load and reducing training time. The Information Portal being linked to applications via the Integration Bus enables the Division to offer new and unique applications. With the power of the IT Architecture, the Division will be able to streamline applications and offer them to users in precisely the way they can be most productive.

Personalization
The Information Portal offers users the opportunity to set up their computer desktop to let them be most productive. The technologies with the Information Portal that enable this include:

- Page Builder – This is an easy to use, point and click tool for organizing what panes a user wants on their desktop and what data they want on each pane.
- Content Filters – The user can establish what it wants from any specific data source through an easy to use tool for setting Content Filters. Users decide what they want from each data feed; for instance, they can elect to receive all the data or just some of data such as a weekly average.
- Personal Alerts – A user can elect to be informed of any event or transaction that occurs within the Division and recorded by a Division information and/or control system and/or telecommunications system. For instance, a user can elect to receive an alert about specific types of sewer main problems. Then, once the event is recorded (for instance, remotely recorded by a field worker with a mobile computer), an alert flash would be seen on the user's desktop. Alerts of this kind can also be automatically escalated, so that if appropriate parties have not repaired the problem and "cleared" the alert after a set period of time, a new alert can flash on the desktop of someone in the Division who is higher up the decision/action chain.
- Folders and Channels – The Information Portal enables users to set up any number of folders for accessing, using, and/or storing data, helping to cut down on desktop clutter. Users can also set up any number of data feed channels (constrained by their authorization and the availability of the data sources).

e-Intelligence
The Information Portal comes with a number of automation tools to assist users in analyzing data and thereby enabling staff to make more rapid and more accurate decisions. These automation

tools have "smarts" built into them; that is, these tools can be programmed to take selected data feeds and automatically transform those data feeds into user definable reports and queries. Some of these "smart" or "electronically intelligent" tools include:

- Reporting – This is a software tool automates the creation of reports that a user needs, either for decision making or to meet regulatory demands. With this automation report generation feature, data feeds selected by the user are automatically inserted into pre-formatted reports.
- OLAP Analysis – OLAP stands for On Line Analytical Processing, which refers to the capability of automating the analysis of data feeds based on rules set by the Division. This is similar to the functionality currently being provided by the Business Objects software that the Division uses to access County finance data. For instance, data about capital projects can be automatically analyzed according to the needs of different users, with the results fed to each user's desktop on either a continuous or periodic basis.
- Ad-Hoc Queries – In addition to the automated and pre-selected reporting and analysis tools mentioned above, users also have the ability to make their own queries per their own designated criteria. As with all the other E-Intelligence tools in the Information Portal, this one is configured to match the business processes, business rules, and data models of the Division as a whole; this ensures users that their queries will be consistent with how the Division performs its business.
- Data Visualization (GIS) – Through a GIS-enabled pane, the user can view location-referenced data about facilities with the Information Portal.

Security

Some of the most important features about the Information Portal are its security features. The Information Portal offers the Division significantly more security for its information and computing assets than it currently has. Among the most important security features are:

- Authentication – The Information Portal authenticates a user based on a password. The technology behind this authentication feature is highly robust and utilized by the top security agencies throughout the United States.
- Role-based Authorization – When the user logs with their password, the Information Portal automatically knows what roles the user has in the business processes within the Division. The user could have a role in one workflow to initiate a new budget or work request, while having a completely different role in another workflow to approve a request. The Information Portal's authorization tool keeps track of the various roles that Division managers and staff have, so that appropriate reports and action requests come to their desktop.
- Encryption – The Information Portal has a high-security encryption capability utilized by the top security agencies throughout the United States.
- LDAP Directory Services – LDAP stands for Lightweight Directory Access Protocol. The directory services built into the Information Portal are the latest and most effective available on the market. The Division can manage data access with these LDAP Directory Services.

Behind the scenes, not visible to the user, are some other functions that make the Information Portal the powerhouse that it is. These functions include:

- Scheduling Services – These functions allow events (i.e., transactions, alerts, etc.) to be synchronized and scheduled via the Information Portal.

- Search Services – The Information Portal can search any linked data source for information based on key search words. This allows users to find data even if they aren't aware of where it might be located.
- Audit and Logging Services – The Information Portal automatically logs details about all events (i.e., transactions, alerts, etc.). Users can use these logs to find information about how often certain events occur, which the Information Portal can then report on.
- Load Balancing Services – These functions allow the Information Portal performance to remain good even during times of high data input and/or output.
- XML Services – These functions are associated with the Information Portal's ability to use the XML data format, which is the universal standard for formatting data.
- Data Access Services – These functions enable the Information Portal to control the data accessibility.
- Repository Management Services – These functions are associated with the Information Portal's ability to manage the storage of events and personalization details.

1.5. The e-Business Connector Functions

The e-Business Connector is used to implement e-Business and e-Government services to outside parties. For instance, Pre-Treatment Industrial Waste Management could use the e-Business Connector to electronically communicate warnings and violations, handle notification of fines, and process electronic payments from industrial waste producers. Other uses of the e-Business Connector would be in the areas of Construction Management, Parts and Supplies Procurement, and transaction processing with County finance and human resources groups. Exchange of information and transactions between WTD and external parties – such as other agencies, contractors, and/or industrial waste producers – can be automated with the e-Business Connector. The e-Business Connector then makes use of Integration Bus to feed information and transaction updates to the Information Portal and its users.

1.6. The Value of the IT Architecture

In total – with the Information Portal, the Integration Bus, and the e-Business Connector – the IT Architecture allows the WTD to more effectively manage its information and computing resources so that staff are more productive. The IT Architecture provides the Division with a straightforward migration path to achieve more effective information and control systems, and the IT Architecture simplifies the number of systems that need to be supported and maintained. In contrast to the current situation in which the Division has over 70 different systems, the IT Architecture provides the means to reduce the number of systems (as illustrated below).

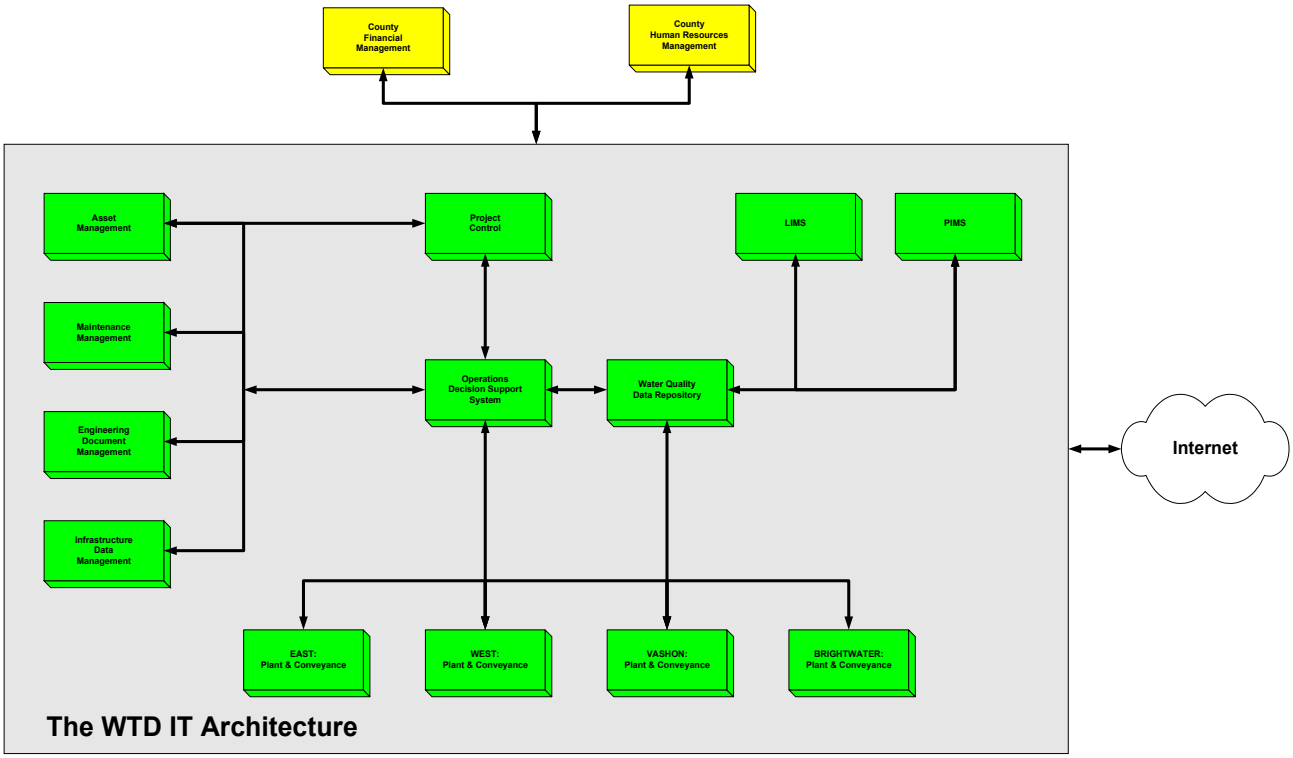

Figure D-7: Information Portal

2. THE IMPLEMENTATION STRATEGY

The strategy for implementing the WTD IT Architecture is based on best practices for implementing integrated systems with widely shared data. The project interdependencies and timelines for the projects recommended in the Master Plan are the bases of the implementation strategy. The strategy consists of the following phased efforts that stretch from the every beginning of the Master Plan and conclude almost 10 years later with the IT Architecture firmly in place. The implementation strategy is implemented by taking the following steps:

1) Immediate replacement of obsolete systems – primarily plant and offsite control systems – in anticipation of future integration

2) Implementation of Information Portal, in order to provide immediate relief for WTD managers in their access to existing applications and databases

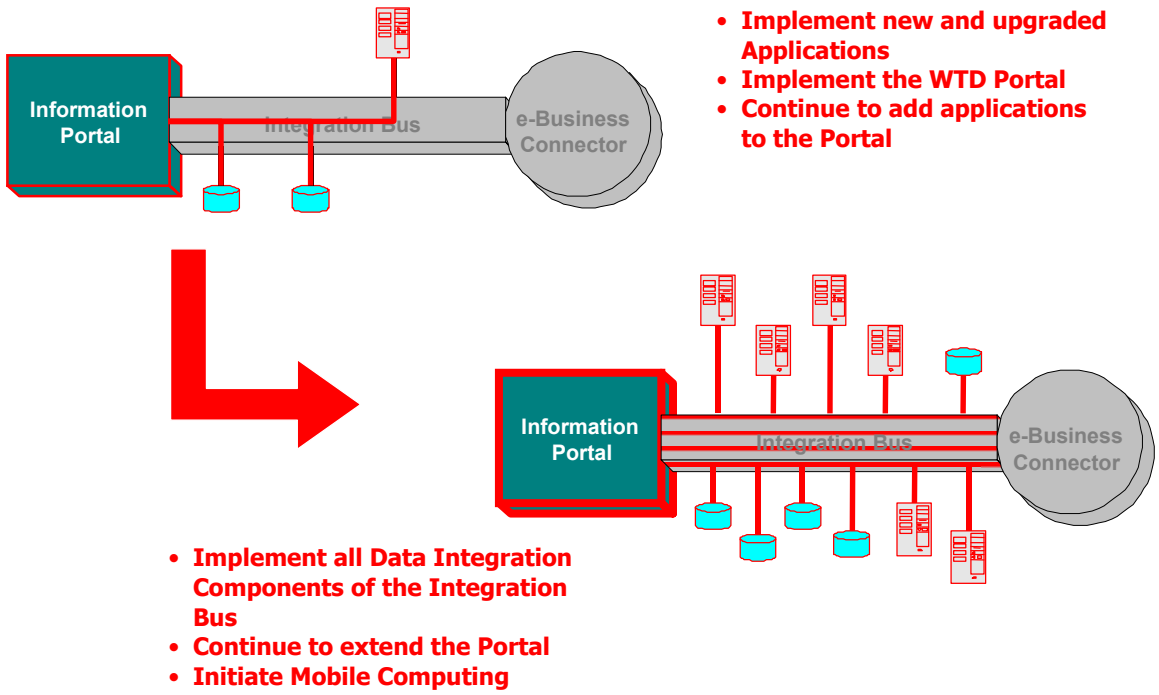

Figure D-8: Implementation Strategy Steps 1 and 2

3) Iterative implementation of new applications, linking them initially to the Information Portal to achieve presentation-level integration and later to the Integration Bus to achieve real-time data updates

4) Implementation of the Data Transport and Data Correspondence layers of the Integration Bus (illustrated below), enabling data-level integration of existing and new systems; implementation of Database Adapters

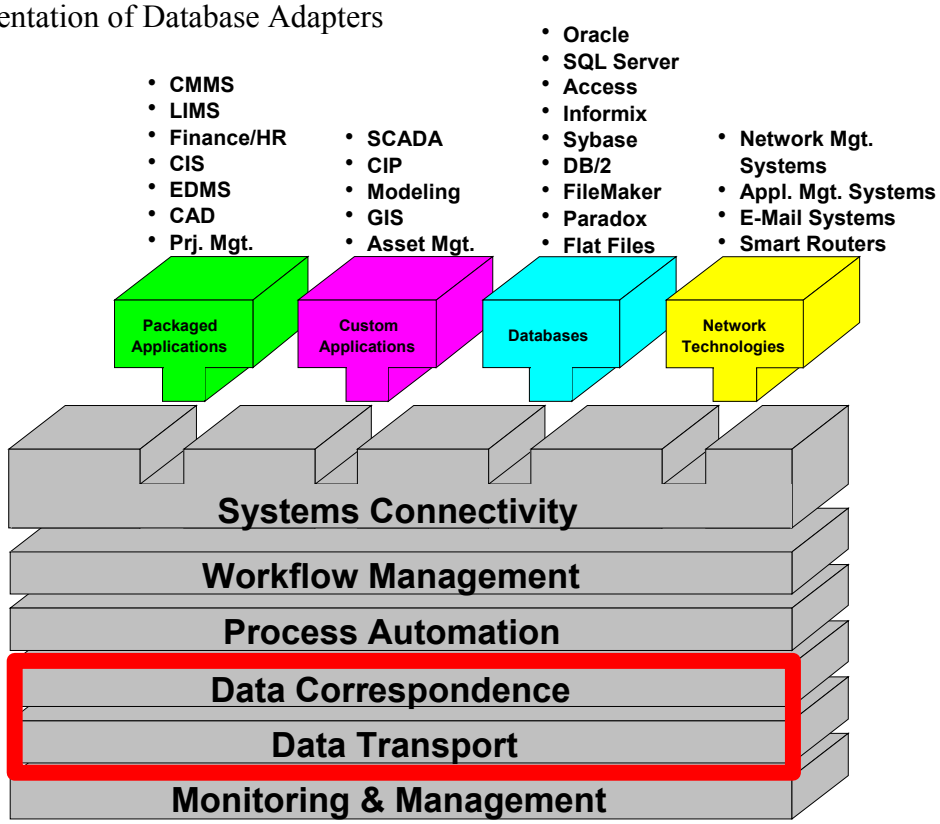

Figure D-9: Implementation Strategy Step 4

5) Implementation of the Process Automation and Workflow Management layers of the Integration Bus (illustrated below), enabling functional integration of applications and workflow automation; implementation of Application Adapters

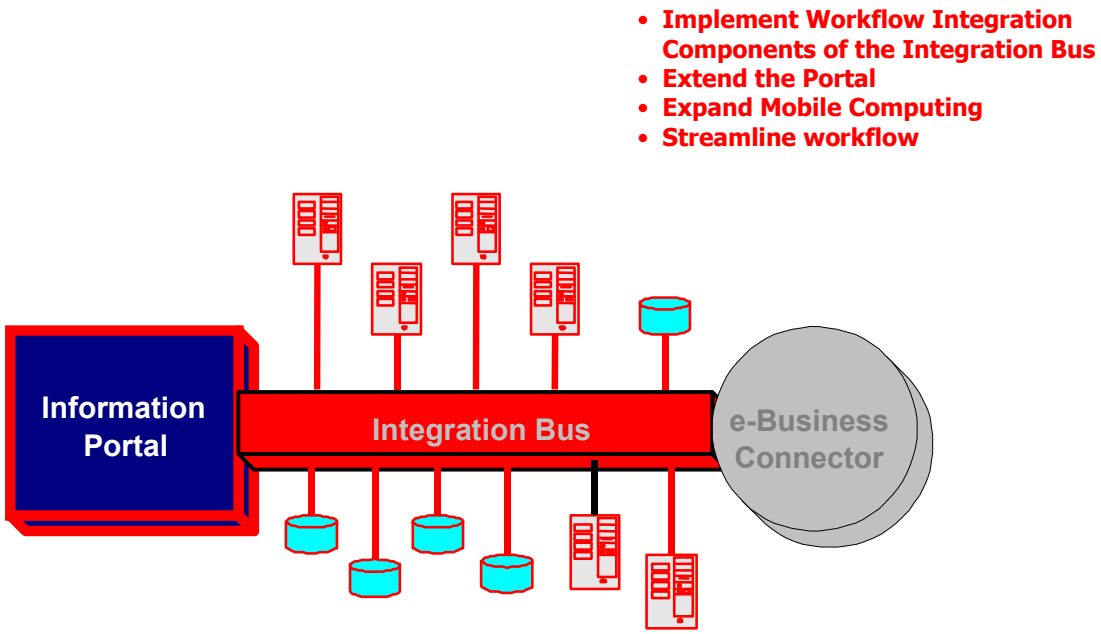

Figure D-10: Implementation Strategy Step 5 - Architecture

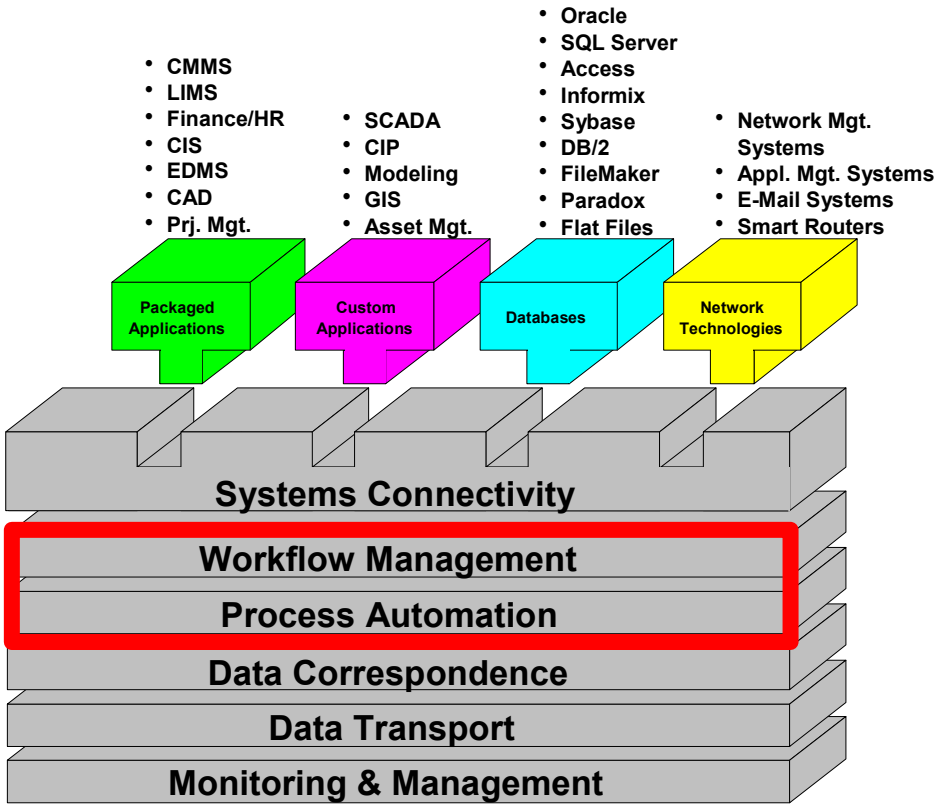

Figure D-11: Implementation Strategy Step 5 – Integration Bus Layers

6) Implementation of Monitoring and Management layer of the Integration Bus, enabling efficient maintenance and support of the Integration Bus and the applications and databases connected to it

7) Implementation of the e-Business Connector and the initiation of true e-Business with outside suppliers, customers, and agencies

Upon completion of all steps of the implementation of the WTD IT Architecture, the WTD will have replaced and integrated all of the existing systems. The Division will have successfully transitioned from its current situation to one that fast, easy and reliable access to accurate and relevant job specific data.